EG&G

INSTRUCTION MANUAL

NUMBER B-3387 A
1 SEPTEMBER 1968

T.E.

MODEL 590
CALIBRATED LAMP SYSTEM

MP MASTER
MA29009

ELECTRONIC PRODUCTS DIVISION
EG&G, INC., 160 BROOKLINE AVE., BOSTON, MASSACHUSETTS 02215

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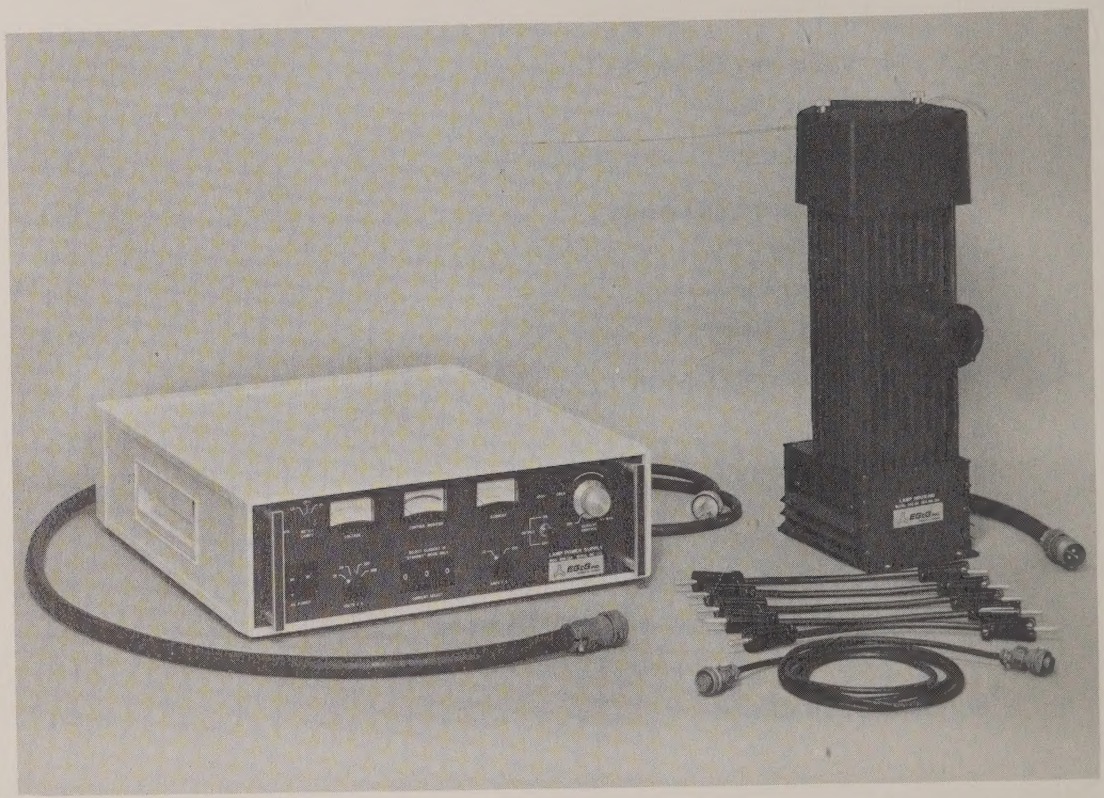


Figure 1. Model 590 Calibrated Lamp System.

1.1 GENERAL

The EG&G Model 590 Calibrated Lamp System (Figure 1) enables accurate reproducible operation of most tungsten lamp standards (also of certain other lamps of "non-standard" rating) by eliminating fluctuating voltages, ripple, etc., which greatly affect output light accuracy.

The System comprises two basic units: a Lamp Power Supply, Model 590-11A, and a Lamp Housing, Model 590-21. The solid-state Power Supply furnishes programmed voltage and RMS-regulated current in preset combinations at power levels ranging from 2 to 1000 W. The chopper-stabilized square-wave current is feedback-regulated within 0.25% of the selected digital RMS value for precise control of light output.

The Lamp Housing, of stacked-section design, can be used in seven different configurations (termed Models 590-21 through -27) to accommodate a broad range of lamp types and sizes (this versatility is achieved by adding the appropriate full, half, or snouted-center casting and the required Lamp Holder to the basic Model 590-21). The complete assembly is a light-tight one in which reflective error is held to a minimum. The housing center segment includes a large, fixed, 3-inch aperture which facilitates custom mounting of lenses, filters, and other optical elements used in special applications. The aperture is equipped with a demountable, variable-area iris (maximum opening 1-5/8 inches). Variable-flow forced-air cooling is incorporated in the base section of the Lamp Housing. The seven housing configurations are shown in Figure 2. A wide variety of self-aligning, interchangeable Lamp Holders (Models 590-20-11, -12, etc.) with pin plug-in contacts are available for tungsten lamps of most types (Figure 3). The Lamp Housing is cable-connected to the Lamp Power Supply. Desk or optical bench mounting is convenient.

1.2 EQUIPMENT SPECIFICATIONS

Electrical Characteristics

Input Voltage Range
: 108-125 V, 50-60 Hz

Output Power
: Variable to 1 kW maximum

Lamp Voltage Range
: 2-160 V (patch-selected range is 4-160 V)

Lamp Current (two scales, both digitally preset)
: 1.0-9.99 A, 10.0 to 50.0 A

Waveform
: 1-2 kHz square wave (no flicker)

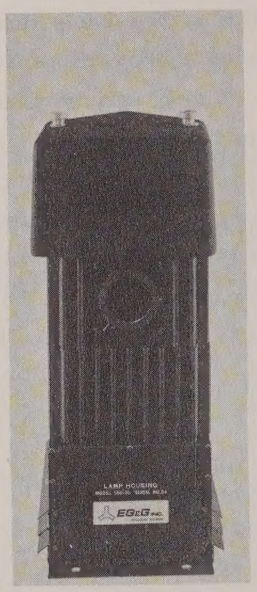
Second Harmonic Content
: Less than 0.001%

Current Control
: Automatic RMS regulation to 0.25% of preset value

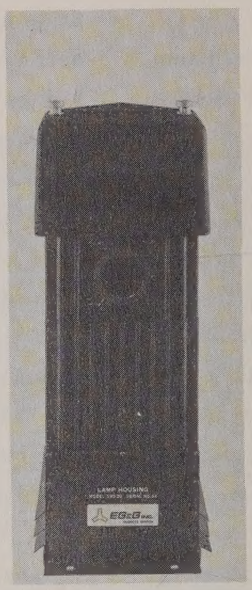
Correction Rate
: 100 ms maximum

Light Output Ripple
: Less than 0.02% at 120 Hz

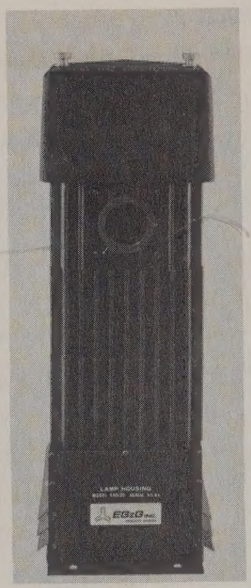
Electrical Efficiency
: Greater than 95%



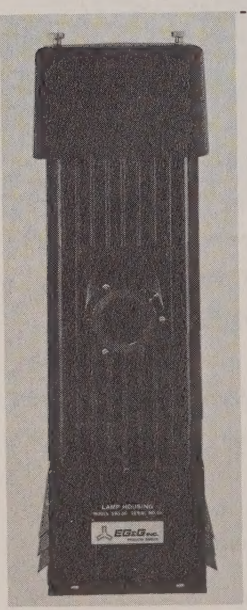
Model 590-21
(Basic Configuration)



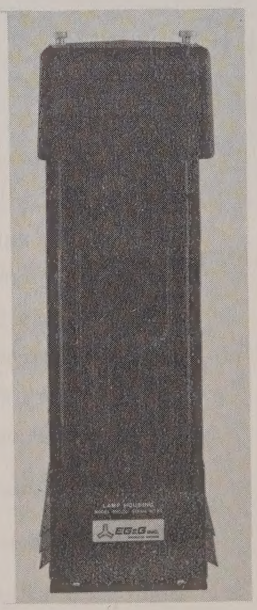
Model 590-22



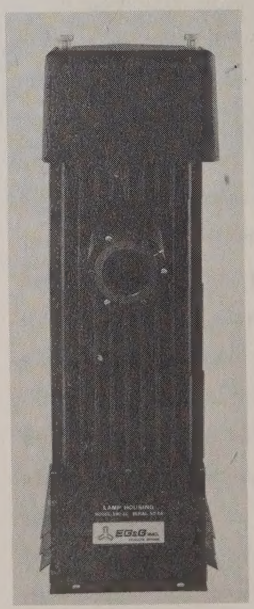
Model 590-23



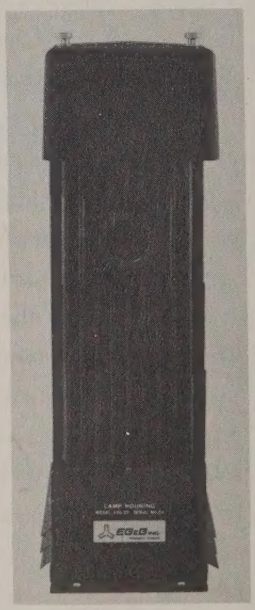
Model 590-24



Model 590-25



Model 590-26



Model 590-27

Figure 2. Lamp Housing Configurations.

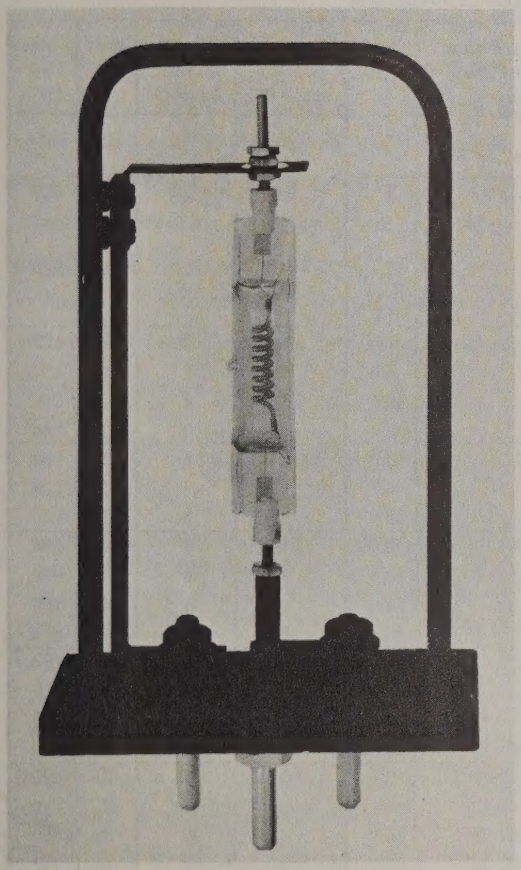


Figure 3. Typical Self-Aligning Interchangeable Lamp Holder With Pin Plug-In Contacts.

Meter Accuracy

2% full scale (nominal visual read-out; lamp current and voltage automatically controlled)

Panel Lighting

Adjustable (low, high, off)

Lamp Power

Controlled start sequence with standby power for Lamp Housing cooling fan

Physical Characteristics

Lamp Power Supply, Model 590-11A

Height	6-1/2 in.
Width	19 in.
Depth	28 in.
Weight	80 lb.

Lamp Housing, Model 590-21 (Basic) Through Model 590-27

Lamp Housing dimensions and weights vary, depending upon the housing configuration selected; this, in turn, depends on the accessory housing casting(s) and Lamp Holder used.

1.3 EQUIPMENT SUPPLIED

The Model 590 Calibrated Lamp System includes a Model 590-11A Power Supply, a (basic) Model 590-21 Lamp Housing, additional casting segments as required for a particular lamp application (see below), and the appropriate Model 590-20-10 Series Lamp Holder(s). Also furnished are five patch cables and one interconnecting cable.

Additional Lamp Housing castings and holders may be obtained for various lamp applications. Table 1 is a representative listing of lamps and associated required lamp holders which can be operated in the various Lamp Housing configurations of the System. (The System is, however, capable of operating with various other lamp types than those listed in Table 1.) Also included is information relative to accessory housing casting(s) required to adapt the basic Lamp Housing (Model 590-21) to each configuration. (The accessory housing castings are: the Model 590-00-11 Full Casting, the Model 590-00-12 Half Casting, and the Model 590-00-13 Snouted-Center Casting.)

Table 1. Lamp Housing Configurations and Lamp Data.

Lamp Type* (G.E.)	Lamp Holder Model	Lamp Housing Configuration	Accessory Casting(s) Required To Adapt From Basic Housing Configuration	Base† Type	Approx. Operating Voltage (V)	Approx. Operating Current (A)	Watts	Blower Control Setting
1000 W Quartz Iodine V-Line DXW 120V	590-20-11	590-21	NONE	CE	128	8.3	1000	HIGH
200 W Quartz Iodine Q6.6A/T4/CL with Ceramic Terminals	590-20-12A	590-21	NONE	CE	36	6.5	200	MED
200 W Quartz Iodine Q6.6A/T4/CL with Flexible Leads	590-20-12B	590-21	NONE	FL	36	6.5	200	MED
5A/T8/1SC	590-20-13A	590-21	NONE	SCB	12	5	40	LOW
5A/T8/1DC	590-20-13B	590-21	NONE	DCB	12	5	40	LOW
5A/T8½	590-20-13C	590-21	NONE	MES	4	6	18	OFF
9A/T8½/1P	590-20-13D	590-21	NONE	MES	8	9	54	LOW
9A/58½/1P	590-20-14A	590-22	590-00-12	MEP	8	9	54	LOW
9A/T8½	590-20-14B	590-21	NONE	MES	8	9	54	LOW
9A/T8½P	590-20-14C	590-22	590-00-12	MEP	8	9	54	LOW
9A/T10P	590-20-15A	590-22	590-00-12	MEP	8	9	54	LOW
18A/T10/1P	590-20-15B	590-22	590-00-12	MEP	8	18	108	MED
18A/T10/2P	590-20-15C	590-22	590-00-12	MEP	8	18	108	MED
18A/T10/3P	590-20-15D	590-23	590-00-11	MEP	8	18	108	MED
18A/T10/1	590-20-16A	590-23	590-00-11	MES	8	18	108	MED
18A/T10/2	590-20-16B	590-23	590-00-11	MES	8	18	108	MED
18A/T10/3	590-20-16C	590-23	590-00-11	MES	8	18	108	MED
18A/T10/6	590-20-16D	590-23	590-00-11	MES	16	18	180	MED
20A/T24	590-20-17A	590-27	590-00-11, 590-00-12	MOS	8	20	120	MED
20A/T24/2	590-20-17B	590-27	590-00-11, 590-00-12	MOS	8	20	120	MED
30A/T24	590-20-17C	590-27	590-00-11, 590-00-12	MOS	8	30	180	MED
30A/T24/6	590-20-17D	590-27	590-00-11, 590-00-12	MOS	8	30	180	MED
30A/T24/5**	590-20-17E	590-26	590-00-11, 590-00-12, 590-00-13	MOS	8	30	180	MED
30A/T20/3	590-20-18A	590-22	590-00-12	MOS	8	30	105	MED
30A/T20	590-20-18B	590-22	590-00-12	MOS	8	30	165	MED
30A/T20/4	590-20-18C	590-22	590-00-12	MOP	12	30	225	MED
30A/T24/13***	590-20-19A	590-24	590-00-11, 590-00-12, 590-00-13	MOB	8	30	105	MED
30A/T24/17***	590-20-19B	590-24	590-00-11, 590-00-12, 590-00-13	MOB	8	30	105	MED
40A/T24	590-20-19C	590-25	590-00-11, 590-00-12	MOB	8	40	240	MED

*Ribbon filament lamps except for those lamps having CE and FL bases; these latter are coil filament lamps.
**3/8-in. window extension beyond diameter.
***1-1/4-in. window extension approx. 4 in. from filament (replaces G.E. Types 30A/T24/1, 30A/T24/3, and 30A/T24/7).
†Base Code:
CE = Ceramic End Term
FL = Flexible Lead
SCB = Single Contact Bayonet
DCB = Double Contact Bayonet
MES = Medium Screw
MOS = Mogul Screw
MEP = Medium Prefocus
MOP = Mogul Prefocus
MOB = Mogul Bipost

2.1 INSTALLATION REQUIREMENTS

The Model 590 Calibrated Lamp System can be mounted directly on a desk or table, or on a laboratory or optical bench. Initial setup and general operating instructions are provided in the following paragraphs. It is recommended that the procedures for operating the System be strictly followed to avoid damage to the lamp and to the Power Supply.

CAUTION

To prevent accidental actuation of mercury relays (K4 and K5), operate Power Supply in horizontal position only (15 degree maximum).

2.2 INITIAL SETUP

Lamp Installation

Before the System is operated, the lamp should be installed in the Lamp Housing. Proceed as follows:

a. Remove two knurled nuts from top of Lamp Housing and lift off Housing top (to facilitate installation, casting segments may be removed).

b. Insert lamp into Lamp Holder.

c. Firmly push handle (U-Frame) Lamp Holder straight down into three-pin socket in Lamp Housing. (Lamp Holders for Mogul Screw and Mogul Prefocus lamp standard bases are not equipped with a handle. See Figure 3 for a view of a commonly used Holder.)

d. Set up Lamp Housing with appropriate casting configuration (Table 1 and Figure 2).

NOTE

To prevent light leaks, spread a thin layer of silicone grease between housing castings.

e. Replace Housing top and secure with knurled nuts.

Connections and Pre-Operation Procedures

Continue with the initial setup of the System according to the following steps:

a. Connect the Lamp Power Supply to the Lamp Housing by mating the large umbilical interconnecting cables which emerge from the units at the rear.

b. Attach the smaller interconnecting cable (supplied) from the Lamp Power Supply connector J1 to the equivalent connector on the Lamp Housing (provides power to operate the blower in the Lamp Housing).

c. Adjust iris opening on Lamp Housing (to be determined by operator).

d. Ensure AC POWER and METER LAMPS switches are in OFF position (see Figure 4). Also check that a-c line power cable from Power Supply has not been connected.

WARNING

Voltages are present at rear jumper connectors when lamp is operating.

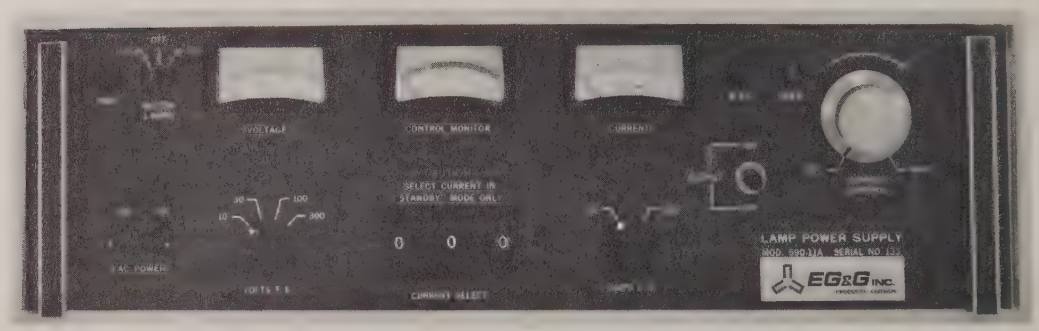
e. Arrange patch cables on rear panel of Lamp Power Supply as dictated by lamp operating voltage (see Tables 1 and 2 and Figure 4).

f. Set FAN CONTROL switch at rear of Lamp Housing base as indicated by lamp being used (see Table 1 and Figure 5).

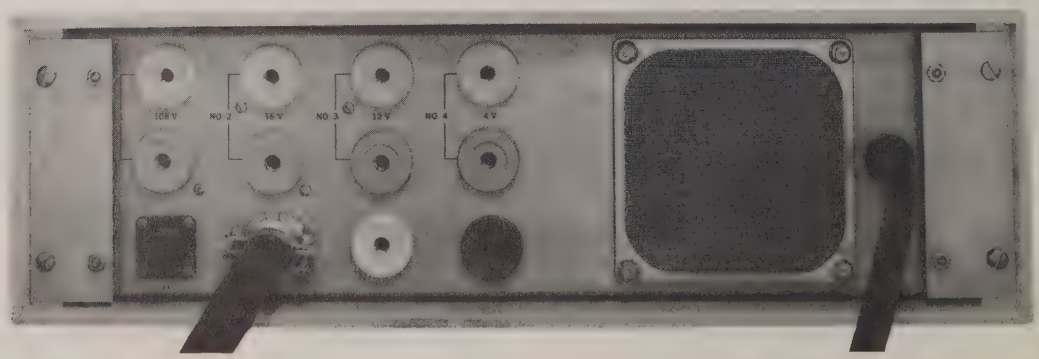
g. Set CURRENT SELECT digital switches in accordance with operating current of lamp (Table 1).

h. Select proper current range on AMPS F.S. switch in accordance with operating current of lamp.

i. Select proper voltage range on VOLTS F.S. switch as dictated by voltage required by lamp (and which has been patched in accordingly).



(a) Front View.



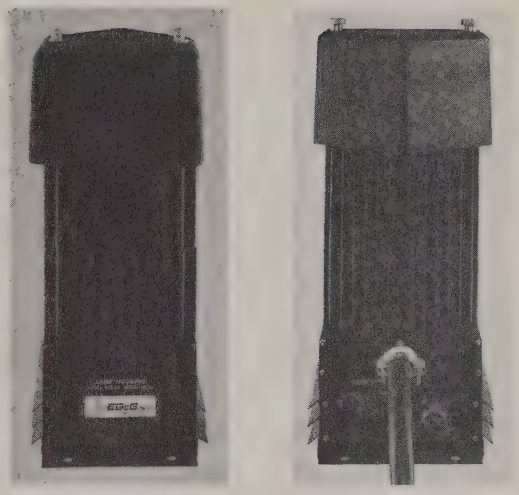
(b) Rear View.

Figure 4. Model 590-11A Lamp Power Supply.

Table 2. Patch Cable Arrangements.

Maximum Voltage	Patch Cable from	to	Patch Cable from	to	Patch Cable from	to	Patch Cable from	to	Patch Cable from	to
4V	W	4B	4Y	R	–	–	–	–	–	–
8V	W	3B	3Y	4Y	4B	R	–	–	–	–
12V	W	3B	3Y	R	–	–	–	–	–	–
16V	W	3B	3Y	4B	4Y	R	–	–	–	–
20V	W	2B	2Y	3Y	3B	4Y	4B	R	–	–
24V	W	2B	2Y	3Y	3B	R	–	–	–	–
28V	W	2B	2Y	3Y	3B	4B	4Y	R	–	–
32V	W	2B	2Y	4Y	4B	R	–	–	–	–
36V	W	2B	2Y	R	–	–	–	–	–	–
40V	W	2B	2Y	4B	4Y	R	–	–	–	–
44V	W	2B	2Y	3B	3Y	4Y	4B	R	–	–
48V	W	2B	2Y	3B	3Y	R	–	–	–	–
52V	W	2B	2Y	3B	3Y	4B	4Y	R	–	–
56V	W	1B	1Y	2Y	2B	3Y	3B	4Y	4B	R
60V	W	1B	1Y	2Y	2B	3Y	3B	R	–	–
64V	W	1B	1Y	2Y	2B	3Y	3B	4B	4Y	R
68V	W	1B	1Y	2Y	2B	4Y	4B	R	–	–
72V	W	1B	1Y	2Y	2B	R	–	–	–	–
76V	W	1B	1Y	2Y	2B	4B	4Y	R	–	–
80V	W	1B	1Y	2Y	2B	3B	3Y	4Y	4B	R
84V	W	1B	1Y	2Y	2B	3B	3Y	R	–	–
88V	W	1B	1Y	2Y	2B	3B	3Y	4B	4Y	R
92V	W	1B	1Y	3Y	3B	4Y	4B	R	–	–
96V	W	1B	1Y	3Y	3B	R	–	–	–	–
100V	W	1B	1Y	3Y	3B	4B	4Y	R	–	–
104V	W	1B	1Y	4Y	4B	R	–	–	–	–
108V	W	1Y	1B	R	–	–	–	–	–	–
112V	W	1B	1Y	4B	4Y	R	–	–	–	–
116V	W	1B	1Y	3B	3Y	4Y	4B	R	–	–
120V	W	1B	1Y	3B	3Y	R	–	–	–	–
124V	W	1B	1Y	3B	3Y	4B	4Y	R	–	–
128V	W	1B	1Y	2B	2Y	3Y	3B	4Y	4B	R
132V	W	1B	1Y	2B	2Y	3Y	3B	R	–	–
136V	W	1B	1Y	2B	2Y	3Y	3B	4B	4Y	R
140V	W	1B	1Y	2B	2Y	4Y	3B	R	–	–
144V	W	1B	1Y	2B	2Y	R	–	–	–	–
148V	W	1B	1Y	2B	2Y	4B	4Y	R	–	–
152V	W	1B	1Y	2B	2Y	3B	3Y	4Y	4B	R
156V	W	1B	1Y	2B	2Y	3B	3Y	R	–	–
160V	W	1B	1Y	2B	2Y	3B	3Y	4B	4Y	R

Key: W = White B = Blue
Y = Yellow R = Red



(a) Front View. (b) Rear View.

Figure 5. Lamp Housing, Model 590-21.

j. Ensure CURRENT CONTROL rotary switch is in OFF position (fully ccw).

k. Ensure OUTPUT switch is in center position (spring-return switch).

l. Carefully read over explanations of functions of controls and indicators as given in the following subsection (referring to Figures 4 and 5 while so doing), then continue on to subsection 2.4, OPERATING PROCEDURE.

2.3 CONTROLS AND INDICATORS

Lamp Power Supply (front unless otherwise indicated)

(1) PWR. indicator lamp (red): Lights when power is applied to System (AC POWER circuit breaker switches are in ON position).

(2) STBY. indicator lamp (amber): Lights when power is applied to

System. (Goes out when OUTPUT switch is placed in ON position.)

(3) OPER. indicator lamp (amber): Lights when OUTPUT switch is in ON position and remains illuminated while lamp is being operated.

(4) VOLTAGE meter: Monitors and indicates lamp voltage.

(5) CONTROL MONITOR meter: Indicates operational status of Power Supply. Dial is divided into three color regions: blue (INCREASE) indicates Power Supply is not operating at set current; green (OPERATE) indicates Power Supply is operating properly; red (DECREASE) indicates Power Supply is above set current.

(6) CURRENT meter: Indicates approximate (±2%) output current. (Coarse adjust for CONTROL MONITOR.)

(7) METER LAMPS switch: Adjusts for desired LO/HI meter lamp brilliance.

(8) AC POWER circuit breakers: Provides 117V AC to the System in the ON position.

(9) VOLTS F.S. switch: Permits selection of 10, 30, 100, or 300-V ranges, as required by voltage value selected by patch cables.

(10) OUTPUT switch: Transfers energy to lamp.

(11) CURRENT CONTROL switch: Permits uniform and accurate control of current output (five-turn control).

(12) CURRENT SELECT switches: Permits precise digital selection of lamp current.

(13) AMPS F.S. switch: Permits selection of 10- or 100-ampere ranges, depending on desired current (indicated by CURRENT SELECT switches).

(14) Patch cable arrangement (rear): Enables selection of appropriate lamp voltage, to a maximum of 160V. (Blue and yellow inputs represent starts and finishes of transformer windings, red and white inputs, the termination points.)

Lamp Housing (front unless otherwise indicated)

(1) Iris control: While facing housing, control lever is located on left side of iris. Used to open and close iris, as desired (maximum opening 1-5/8 in.).

(2) FAN CONTROL switch (rear): Controls blower in base of Housing. LOW, MED, or HIGH setting is determined by lamp being operated.

2.4 OPERATING PROCEDURE

After all controls have been set as instructed in subsection 2.2, proceed as follow to operate the System:

a. Connect Lamp Power Supply power input cable to a 117-V a-c outlet.

WARNING

Voltages are present at rear jumper connectors when lamp is operating.

b. Place AC POWER circuit breakers to ON position. (The PWR. and STBY. lamps will light.)

c. Adjust METER LAMPS switch for desired meter illumination.

d. Check CURRENT SELECT switches are at proper current settings in accordance with lamp used (Table 1).

CAUTION

These switches are to be moved in "standby" mode only.

e. Place OUTPUT switch (momentary contact) to ON position. STBY. lamp will extinguish and OPER. lamp will light.)

f. Rotate CURRENT CONTROL knob slowly clockwise until amperes reading on CURRENT meter approximates CURRENT SELECT switches setting (set meter reading slightly higher).

NOTE

Performing this step slowly will contribute to maximum lamp life.

g. Allow ten seconds for CONTROL MONITOR meter to reach balance (pointer is in green area of scale). If balance is then not achieved, and:

   1. pointer is in blue (INCREASE) region, turn CURRENT CONTROL knob clockwise until indication is in green (OPERATE) region; or
   2. pointer is in red (DECREASE) region, turn CURRENT CONTROL knob counterclockwise until indication is in green (OPERATE) region.

The Model 590 Calibrated Lamp System is now in operation and will, after lamp warmup (depending on the type of lamp), remain stable throughout its operating period. If operation of the System in the standby mode is desired:

a. Slowly turn CURRENT CONTROL knob counterclockwise to OFF (detent) position. (Again, performing this step slowly will contribute to maximum lamp life.)

b. Place OUTPUT switch to OFF position.

This procedure will automatically remove power from the lamp in the Lamp Housing, while permitting the Lamp Power Supply to remain in a "ready" status. Before System operation can be resumed, the CURRENT CONTROL knob and OUTPUT switch must be returned to their previous positions as per the operating procedure.

NOTE

The CURRENT CONTROL knob must be returned to a lock-in position (fully ccw) to permit Power Supply to go from a standby to an operational status. This is a safety interlock feature.

Upon completion of operation, the CURRENT CONTROL knob must slowly be reduced to the OFF position. The OUTPUT switch must then also be placed to OFF. The System should then be allowed to remain in the standby mode for 10 to 15 minutes before the AC POWER circuit breakers are placed in the OFF position. (This procedure will allow the blower in the Lamp Housing to cool the lamp, thus prolonging the life of the lamp.)

3.1 GENERAL

The major circuits of the Model 590-11A Lamp Power Supply are shown in Figure 6 and are described in the following subsections. (Refer also to the functional block diagram, Figure 7, showing signal and current flow among the circuits described herein, and to the complete schematic diagram of the Lamp Power Supply, Figure 8, contained in Section 5).

3.2 FUNCTIONAL CIRCUIT DESCRIPTIONS

SCR Bridge (CR1, CR2, CR3, and CR4)

The silicon controlled rectifier (SCR) bridge, which controls the 115 V a-c input power, consists of two diodes and two SCR's. The SCR's are driven by a unijunction pulse circuit, T201, Q201-Q204, T202, in the drive and control circuits which increases or decreases the average power out of the bridge as the unijunction firing point in time is varied. This firing (angle) references a point on the a-c sine wave to control the firing phase angle of the SCR's in the full-wave bridge.

Filter (L1 and C2)

An L-C filter circuit is provided to smooth the output of the bridge.

Overvoltage Cut-Off (CR38 and CR39)

The filtered output of the bridge then feeds to the power oscillator through an overvoltage cut-off circuit which has the capability of automatically turning off the Power Supply output (by gating on CR39) if the filtered voltage approaches the operating limits of the power oscillator transistors (110V).

Power Oscillator (Q1 through Q4 and T1)

The power oscillator transistors produce a (nominal) 1-kHz square wave and feed this to the output transformer (T1). The output transformer supplies the current to operate the lamp (and also feeds the current-sensing transformers). As already explained in subsection 2.3(14), output voltages from 4 to 160V may be selected by the arrangement of patch cables on the rear of the Power Supply (Table 2).

Current-Sensing Transformers (T3, T4, T5)

The current-sensing transformers T3 and T4, which have 10:1 taps in their primaries, are in series with the lamp load. The AMPS F.S. switch (S7) permits selection of two ampere ranges: 1 to 10 A or 10 to 100 A. The current from transformer T3 is fed to the primary of multiple-tap transformer T5; the primary-to-secondary turns ratio is selected by the CURRENT SELECT switches (S3, S4, and S5). The current from transformer T4 is fed to an ammeter (CURRENT meter M2) which indicates the approximate (±2%) current to the lamp.

Compensation Amplifier (Q5 through Q12)

The null current is programmed to be equal to the digitally selected current. The compensation amplifier reduces losses in the variable-tap transformer T5 by restricting core losses to a low level.

Thermal Element (A2)

The heater (V1) of the thermal element is operated at a fraction of the lamp current.

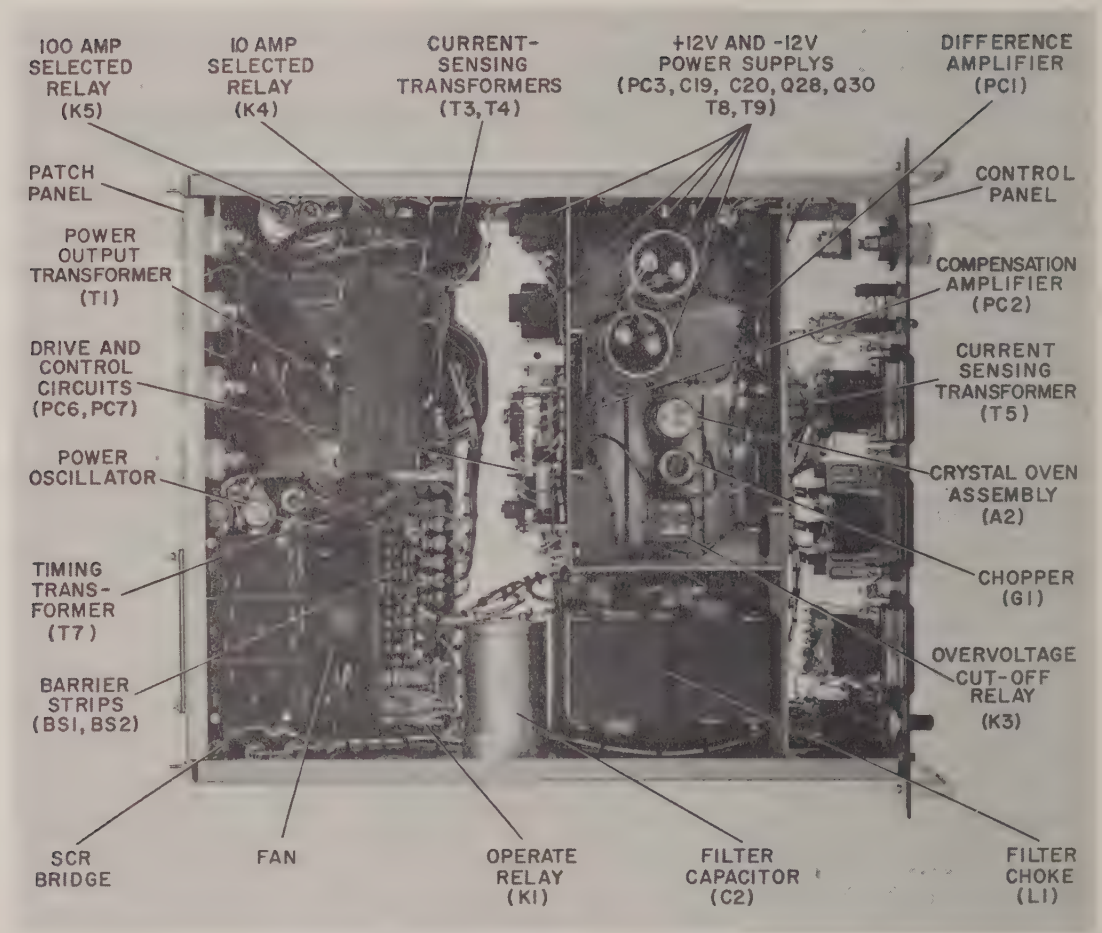


Figure 6. Physical Location of Functional Circuits.

This fraction is selected by the CURRENT SELECT switches. Current through the heater produces a voltage at the thermocouple junction. Balanced operation is achieved when the thermocouple output voltage is equal (and opposite to) the reference voltage. At balance, the lamp current is the value selected. By virtue of the CURRENT SELECT switches, the thermal element has a single point of operation. The thermal element and the bucking reference supply are housed in a temperature-controlled oven and are set to balance at a precise operating point (±0.25%). The difference potential around this operating point is fed to the chopper.

Chopper (G1) and Difference Amplifier (Q13 through Q22)

The chopper is used for a-c modulation and demodulation, and to keep the d-c

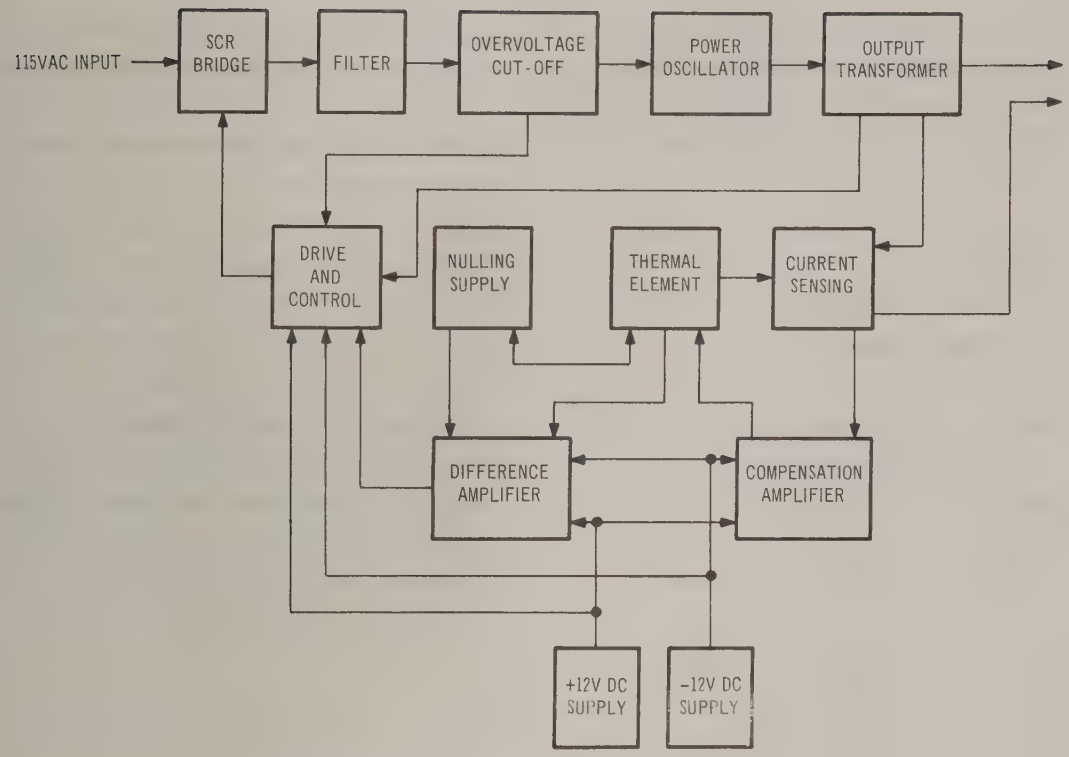


Figure 7. Functional Block Diagram of Model 590-11A Lamp Power Supply.

zero effect of the amplifier suitably low. A small output change around the balance point of the amplifier output will vary the firing points in time (angles) of the SCR's. This will adjust lamp current to that value required to produce thermal element heat current sufficient to make the thermal element thermocouple output equal to the reference value.

Voltmeter (M1)

The accuracy of the (VOLTAGE) voltmeter is ±2%. When a tungsten lamp degrades, the power, and hence the lamp voltage level, change. The voltmeter monitors and indicates changes in the lamp voltage (measured at the output terminals). Thus, the voltmeter provides a means for a constant check on the degree of lamp deterioration.

SCR Control

Currents from the manual control (CURRENT CONTROL potentiometer R206) and the automatic fine control (null balance circuit in the difference amplifier stage Q201 of PC7) are combined and applied to the opposing current generated from the power oscillator output circuit (and which is fed to the control circuit through

transformer T201). This difference current is amplified (Q201, Q202, Q203) and used to drive the unijunction trigger circuit (Q204, etc.) for the bridge SCR's (CR1 and CR2).

Ammeter (M2)

The (CURRENT) ammeter is an approximate-setting device with a ±2% accuracy. The ammeter, used to observe current before the CONTROL MONITOR meter operates, should be set slightly higher than the desired current value. After the CONTROL MONITOR meter indicates a reading, the ammeter can be ignored.

Control Monitor Meter (M3)

The CONTROL MONITOR meter has a three-colored operational scale. The blue area (INCREASE) is the initial status of Power Supply operation, and indicates a need for an increase in output (clockwise rotation on CURRENT CONTROL potentiometer R206). The green area (OPERATE) is the null region which indicates that the Power Supply is operating within its ±0.25% accuracy. The red area (DECREASE) indicates that the power supply is above the set current and that a decrease in output (counterclockwise rotation on CURRENT CONTROL knob) is required.

4.1 PREVENTIVE MAINTENANCE

It is recommended that the Lamp Power Supply, Model 590-11A, be inspected every three months in accordance with the following procedures.

To gain access to the Power Supply chassis, proceed as follows (refer to Figure 4, Rear View):

a. Remove four nuts located at corners of Power Supply back panel.
b. Do not disconnect a-c power cable.
c. Slide Power Supply chassis forward in case as far as it will go (use handles on front of chassis and on side of case).
d. Move AC POWER circuit breakers to ON (PWR. and STBY. lamps will light). Check thermal element cycle light (DS10) to ensure that thermal oven is operating. Move AC POWER circuit breakers to OFF.
e. Disconnect a-c power cable from a-c power source voltage.
f. Remove dust from all parts, connections, and joints of Power Supply by vacuuming.
g. Perform a visual inspection of Power Supply.
h. To replace Power Supply chassis into case, perform the following two steps:
   (1) Slide Power Supply chassis toward rear of case as far as it will go.
   (2) Secure four nuts to screws in corners of Power Supply rear panel.
i. Clean screen filter of fan in accordance with the following procedures:
   (1) Remove four nuts securing screen filter of fan to Power Supply. Remove screen filter.
   (2) Blow out screen filter using high-pressure air.
   (3) Replace screen filter and secure to rear of Power Supply using four nuts.
j. Clean and reset (if necessary) connectors of plug-in (patch) jumper cables.
k. Connect a-c power cable to a-c power source.

4.2 CORRECTIVE MAINTENANCE (TROUBLESHOOTING)

It is suggested that commonly the Lamp Power Supply, Model 590-11A, be returned to the factory for repair; however, should a malfunction occur and factory return not be feasible, reference should be made to the troubleshooting methods described in Table 3 and to the schematic diagram, Figure 8. Faults in the Power Supply circuitry can be localized with reasonable success by a qualified electronics technician when the operating principles are fully understood. Initially, eliminate obvious defects such as burnt parts or wiring, blown fuses, loose connectors, etc.; then perform the indicated

Table 3. Troubleshooting Chart for Lamp Power Supply, Model 590-11A.

Trouble	Probable Cause	Remedy
A-C power on, circuit breakers ON, OPER. light on; no current indication on CURRENT meter.	Open connection to load.	Check for open connection.
A-C power on, circuit breakers trip when switched to ON position or when bringing up CURRENT CONTROL.	Output shorted externally.	Check for external short.
A-C power on, circuit breakers ON, OPER. light on; trips back to STBY when CURRENT CONTROL is increased.	(1) Overvoltage circuit malfunction due to broken wire or bad zener diode (CR38) or SCR (CR39).	(1) Check and repair overvoltage circuit.
	(2) Voltage selected on patch panel insufficient for lamp in use.	(2) Select proper voltage on patch panel (see Tables 1 and 2).
A-C power on, circuit breakers ON, OPER. light on; CURRENT meter (M2) indicates slightly higher current than that set on CURRENT SELECT. CONTROL MONITOR does not operate.	(1) Thermal oven (A2) malfunction.	(1) Replace thermal element (V1).
	(2) Difference amplifier malfunction (PC1).	(2) Check for bad transistor in difference amplifier.
	(3) Chopper malfunction.	(3) Replace chopper (G1).
		(4) Recalibrate (see subsection 4.3).
A-C power on, circuit breakers ON, OPER. light on; CONTROL MONITOR pointer is pinned upscale.	(1) Thermal element (V1) open.	(1) Replace thermal element (V1).
		(2) Recalibrate (see subsection 4.3).
A-C power on, circuit breakers ON, OPER. light on; CURRENT meter indicates slightly higher current than that set on CURRENT SELECT. CONTROL MONITOR pointer is pinned upscale.	(1) Thermal element has shorted bead.	(1) Check thermal element for shorted bead.
	(2) Compensation amplifier malfunction.	(2) Check compensation amplifier.
		(3) Recalibrate (see subsection 4.3).
A-C power on, no output; switch from STBY. to OPER. does not operate.	Relay (K1) faulty.	Replace relay (K1).
Thermal oven cycle light (DS10) does not operate.	(1) Thermal oven (RT1) malfunction.	(1) Replace thermal oven (RT1).
		(2) Recalibrate (see subsection 4.3).
Output failure (trips circuit breaker).	(1) Power oscillator malfunction.	(1) Check power oscillator (see subsection 4.2).
	(2) A-C control circuit malfunction.	(2) Check a-c control circuit (see subsection 4.2).
No ±12 V d-c bias.	±12V d-c power supplies malfunction.	Check ±12 V d-c power supplies (see subsection 4.2).

procedures of Table 3 (see also Figure 6 for locations of functional circuits). If the suggested remedy does not correct the fault, reexamine the circuit descriptions given in subsection 3.2 and further analyze the trouble. The special considerations given in the following paragraphs should be observed when checking circuit operation.

CAUTION

Do not use an oscilloscope on the power oscillator or SCR bridge, unless it is operated from an external, isolated d-c power supply. The chopper (G1) case must be isolated from ground by a nonmetallic mounting screw.

Power Oscillator Check

With a-c power off, operate the power oscillator from an external, isolated d-c power supply, gradually increasing the voltage to a maximum of 20 V. Measure the output across the internal load resistor (R71) in the output transformer (T1) stage. Look for a square-wave output. The current drawn in the operating mode should be in the 200 ±25 mA region.

AC Control Circuit Check

Checkout of the a-c control circuit should be accomplished by disconnecting the power oscillator, and then operating an external load across the filter capacitor (C2) while monitoring the a-c input current.

(±)12-Volt Power Supply Check

With 115-V a-c input power applied to the a-c control circuit, check the ±12-V amplifier power supplies.

4.3 CALIBRATION

It is suggested that the Lamp Power Supply, Model 590-11A, be returned to the factory for recalibration every eight months (or sooner if recalibration is indicated by the troubleshooting procedures of Table 3).

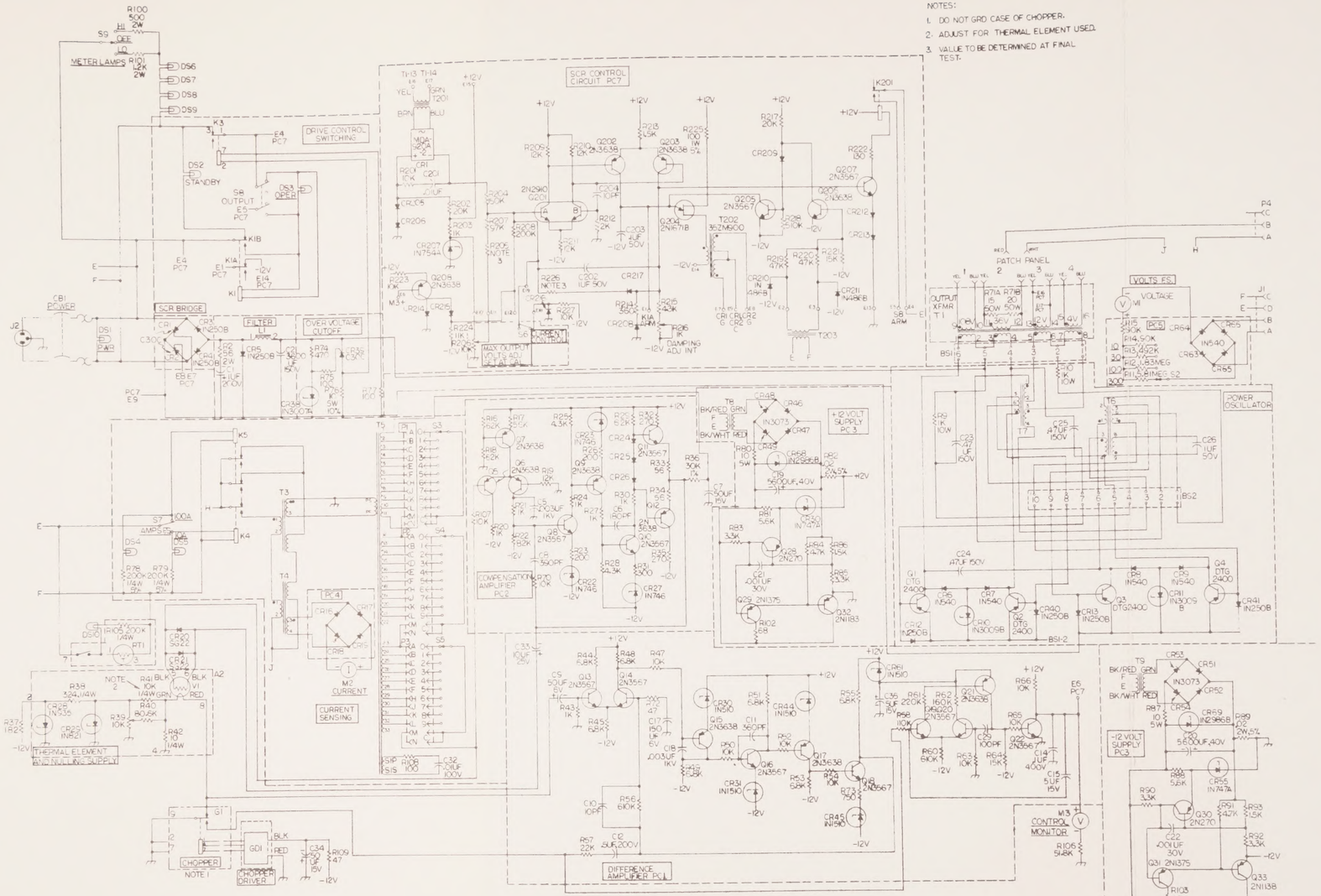


Figure 8. Model 590-11A Lamp Power Supply Schematic Diagram.

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